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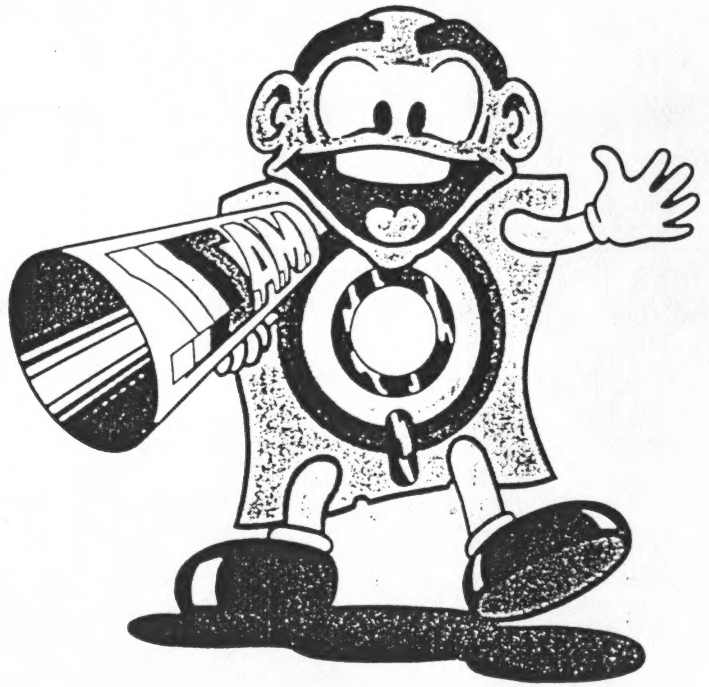
TRONIX PRESENTS

S.A.M.

The Software Automatic Mouth
COMMODORE 64™

OWNER'S MANUAL



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Don't Ask Computer Software

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Introduction

Congratulations!

You have just purchased S.A.M.—the Software Automatic Mouth—a versatile, high-quality speech synthesizer created entirely in software. You have added quality speech to your personal computer for a lower cost than ever before possible and, in the bargain, have gained features that other speech synthesizers cannot offer.

S.A.M. is designed to be easy to use. With a couple of simple program statements, you can add speech to your BASIC or assembly-language programs. When you have mastered the easy-to-learn phonetic alphabet, the inflection system and the use of pitch and speed controls, you will be amazed at what you can make S.A.M. do. And, until then, it will already match the performance of other speech synthesizers.

We strongly suggest that you read this manual carefully while learning to use S.A.M. There are thorough discussions of S.A.M.'s features with illustrative examples of how to implement them. There is also a dictionary of useful words and their phonetic equivalents to help you learn the phonetic spelling system.

Also remember that as a registered S.A.M. owner, you are entitled to our services in answering your S.A.M.-related questions, providing updates and improvements to the S.A.M. program at nominal cost, and helping you with your applications of S.A.M. Yes, this is a not-too-subtle hint that you should send in your S.A.M. owner registration card today. We look forward to hearing from you.

The S.A.M. Package

The S.A.M. diskette contains the following programs:

1. **S.A.M.—**
   This program automatically loads the S.A.M. speech synthesis program, KNOBS, the S.A.M. Wedge and leaves the computer ready to accept phonetic input.
2. **RECITER—**
   RECITER is the English text-to-speech program that interfaces the S.A.M. program with ordinary English text input. It is not used for phonetic input and is loaded in separately only when English text input is desired (see S.A.M. Wedge instructions).
3. **SAYIT—**
   SAYIT is a BASIC program that allows you to enter strings of phonetic or English text and hear them spoken immediately. All of the special features of S.A.M. (pitch control, speed control, KNOBS, etc.) can be accessed within the menu-driven SAYIT program.
4. **DEMO—**
   A BASIC program that demonstrates some of S.A.M.'s features, including the capacity to change his voice and the ability to sing!
5. **SPEECHES—**
   Another BASIC program that featues some familiar texts spoken aloud by S.A.M.
6. **GUESSNUM—**
   A talking game in which the player guesses a secret number between 1 and 100.

We suggest that you do not write additional data on the S.A.M. diskette. Remove it after loading the desired programs.

Using the S.A.M. Programs

S.A.M. is a self-contained machine language program. Your interface to S.A.M. in BASIC is the S.A.M. Wedge, another machine language program. To load S.A.M. and install the S.A.M. Wedge into your C64 computer, follow these instructions:

Diskette Version:

1. Insert the S.A.M. diskette into your disk drive.
2. Type
   LOAD "SAM",8 <RETURN>
3. When the computer prompts READY, type RUN <RETURN>.

Running the Demo Programs

Once S.A.M. is loaded into your computer, you are ready to run any of the BASIC demonstration programs (SAYIT, DEMO, SPEECHES and GUESSNUM). To do so, follow these steps:

Diskette Version:

1. Insert the S.A.M. diskette into your disk drive. Close the disk drive door.
2. Type
   LOAD "filename",8,<RETURN>
   where filename is SAYIT, DEMO, SPEECHES or GUESSNUM.
3. Type
   RUN <RETURN>

Using the S.A.M. Wedge

S.A.M. patches into Commodore BASIC with the use of the S.A.M. Wedge. The S.A.M. Wedge is a machine language utility that adds ten new commands to Commodore BASIC. These commands are used just like any other BASIC commands except that they are used to generate and control S.A.M.'s speech. You can use them in the *immediate mode* in which you simply tell the computer what to do:

SAY "I AM A TALKING COMPUTER."

Or, you can use them in the *deferred mode* in which the Wedge commands are part of a program:

10 SAY "I AM A TALKING COMPUTER."

The ten new commands are the following:

1. **SAY** [string variable or string]
   Commands S.A.M. to speak—
   examples:
   a) SAY "MAY4 NEYM IHZ SAE4M." (phoneme string, immediate mode)
   b) 10 SAY "MY NAME IS SAM." (English string, deferred mode)
   c) A$ = "MY NAME IS SAM."
      SAY A$
      (string variable, immediate mode)
      String arrays may *not* be used with the SAY command.
2. **]PITCH n** Sets S.A.M.'s pitch value to n (see page 16 for values)
   example:
   10]PITCH 64
3. **]SPEED n** Sets S.A.M.'s speed value to n (see page 16 for values)
   example:
   10]SPEED 72
4. **]LIGHT n** Removes the screen display if n = 0, leaves the screen display intact if n = 1. S.A.M. sounds best with the display removed; if the display remains, he will growl a little when he talks.
5. **]SAM** Puts S.A.M. into the phonetic input mode.
   example:
   10]SAM
   20 SAY "AY4 TA0K WIHTH FOW4NIYMZ."
6. **]RECITER** Puts S.A.M. into the English input mode (provided RECITER has been loaded in [see 8 below]).
   example:
   10]RECITER
   20 SAY "NOW I TALK WITH ORDINARY WORDS."
7. **]KNOBS n,m** Allow you to change S.A.M.'s voice using the KNOBS feature (see section on KNOBS for details). Set the "throat" value with n and the "mouth" value with m.
8. **]LOAD** Loads RECITER into memory from the diskette. Make sure RECITER is on the disk you are trying to load it from. When RECITER is loaded into low memory in your C64, it uses approximately 6K Bytes of BASIC memory. If RECITER is loaded into high memory, it only requires 2K of BASIC memory but is incompatible with the DOS Wedge. The S.A.M. Wedge will give you a choice about where in memory to load RECITER.

I. The Phonetic Spelling System

S.A.M. is equipped with a version of the easy-to-learn, very readable International Phonetic Alphabet. There are about 50 phonemes which will let you spell all the words in English. Some sounds from foreign languages are not available in the system at this time.

Why use the phonetic system? There are two compelling reasons: (1) In the phonetic system, all the words will be pronounced correctly; and (2) You can put inflection into the speech however and wherever you want it.

If you have already tried the RECITER text-to-speech program, you know that it does a fair job of pronouncing English words. However, it does make mistakes. Some words sound a little strange and others are difficult to understand. The reasons for this are not hard to understand. English is a language of exceptions rather than rules; words that are spelled alike are pronounced differently ("have" vs. "gave"). A rule system like RECITER cannot pronounce all words correctly unless it stores an enormous dictionary that takes up vast amounts of memory. But the second flaw in text-to-speech conversion is more serious. Such a rule system cannot decide where the stress belongs in what is being said. The phonetic system in S.A.M., on the other hand, allows you to decide where to accent syllables within a word and where to stress words within a sentence.

So it is clear that the preferred way to make S.A.M. speak is with the phonetic alphabet. But how hard is it to use? It's really easier than writing in English because *you don't have to know how to spell!* You only have to know how to say the word in order to spell it phonetically.

Here is the complete list of phonemes, each presented with a sample word containing its sound. Note that there are many vowels, which is why they are all indicated by two letters rather than one.

The phonemes are classified into two categories: vowels and consonants. Among the vowels are the simple vowel sounds such as the "i" in "sit," the "o" in "slot," and the "a" in "hat." These vowels do not change their quality throughout their duration. There are also vowels called diphthongs such as the "i" in "site," the "o" in "slow," and the "a" in "hate," as well as the "oi" in "oil" and the "ow" in "how." These vowels start with one sound and end with another (*e.g.*, "oi" glides from an "oh" sound to an "ee" sound).

The consonants are also divided into two groups: voiced and unvoiced. The voiced consonants require you to use your vocal chords to produce the sound. Such sounds as "b," "l," "n" and "z" fall into this category. The unvoiced consonants, on the other hand, are produced entirely by rushing air and include such sounds as the "p," "t," "h," and "sh" sounds.

The example words have the **sound** of the phoneme, not necessarily the same letters.

VOWELS

IY	f**ee**t
IH	p**i**n
EH	b**e**g
AE	S**a**m
AA	p**o**t
AH	b**u**dget
AO	t**a**lk
OH	c**o**ne
UH	b**oo**k
UX	l**oo**t
ER	b**ir**d
AX	gall**o**n
IX	d**i**glt

DIPHTHONGS

EY	m**a**de
AY	h**i**gh
OY	b**oy**
AW	h**ow**
OW	sl**ow**
UW	cr**ew**

The following symbols are used internally by some of S.A.M.'s rules, but they are also available to the user.

YX	diphthong ending
WX	diphthong ending
RX	R after a vowel
LX	L after a vowel
/X	H before a non-front vowel or consonant
DX	"flap" as in p**i**ty

VOICED CONSONANTS

R	**r**ed
L	**l**low
W	**w**ay
WH	**wh**ale
Y	**y**ou
M	**M**am
N	ma**n**
NX	so**ng**
B	**b**ad
D	**d**og
G	**g**ain
J	**j**udge
Z	**z**oo
ZH	plea**s**ure
V	se**v**en
DH	**th**en

UNVOICED CONSONANTS

S	**S**am
SH	fi**sh**
F	**f**ish
TH	**th**in
P	**p**oke
T	**t**alk
K	**c**ake
CH	spee**ch**
/H	**a**head

SPECIAL PHONEMES

UL	settl**e** (= AXL)
UM	astronom**y** (= AXM)
UN	functi**on** (= AXN)
Q	kitt-**e**n (glottal stop)

Note: The symbol for the "H" sound is **/H**. A glottal stop is a forced stoppage of sound.

On the phoneme chart, you will notice six phonemes—YX, WX, RX, LX, /X, and DX—which are described as being used by S.A.M.'s rule system. However, they have been provided with letter codes so that you may experiment with these special sounds directly. YX and WX are weaker versions of Y and W. RX and LX are smooth gliding versions of R and L. /X is the "h" sound in "who," and DX is the quick flap of the tongue on the upper palate as in the word "pity."

We are now ready to transcribe ordinary speech into its phonetic representation. Let's use the following sentence as an example:

I do my calculations on the computer.

The first step is to say each word aloud and decide how many syllables are in the word. A syllable has *one* vowel phoneme and its associated consonants (if any). We then identify the proper vowel phoneme by comparing its sound to the sounds listed in the table, and do the same for the consonants. The resultant combination of phonemes is the phonetic representation of the syllable. We do this for each syllable in a word.

In our example, the first word—"I"—is a single phoneme, the dipthong "AY." The next word—"do"—is a single syllable comprised of the diphthong "UW" preceded by the voiced consonant "D." The phonetic spelling is therefore "DUW." Similarly, the third word—"my"—again uses the "AY" sound, this time preceded by an "M," resulting in "MAY."

The word "calculations" has four syllables. The first syllable transcribes as "KAEL." The "c" sound is pronounced as "k," unlike the "s" pronunciation in a word like "cell" (notice there is no "C" in the phoneme table). The next syllable—"cu"—transcribes as "KYUW." Note here that the "Y" sound prevents this syllable from being pronounced as "coo." The third syllable comes out as "LEY," and the fourth becomes "SHAXNZ." This word ends with a voiced sound "Z" and not the hissy "S" sound as in "list." You will rapidly discover that many words contain the phonetic combinations "AXL," "AXM" and "AXN." To enhance the readability of the phonetic spelling, the special symbols "UL," "UM" and "UN" can be substituted for these combinations. The "tions" syllable is now written as "SHUNZ." So, "calculations" becomes "KAELKYUWLEYSHUNZ."

The next word "on" becomes "AAN," and "the" becomes "DHAX." By the way, if the word "the" precedes a word beginning with a vowel, it gets pronounced "thee" and is spelled "DHIY." You should also notice that the "th" letter combination has two phonetic representations: unvoiced (TH) as in "thin," or voiced (DH) as in "the."

By now, the steps used in getting from "computer" to "KUMPYUWTER" should already be obvious. Try it.

Once you get used to the phonetic system, it will seem very easy and obvious. Initially, there will be some spellings that seem tricky (Did you know that "adventure" has a "CH" in it?). However, the rule is always to write the word the way you *say* it, not the way you spell it.

To help you learn the system fast, we have provided an English-to-phonetic spelling dictionary of almost 1500 words. Many common words are in the dictionary; some unusual ones are in it as well. If you are really stuck on how to spell a word that isn't in the dictionary, think of another word that sounds like it and that one may be listed.

In any case, don't hesitate to experiment with the phonetic spelling system. Let your ears be your guide. This system is easy to learn, easy to use, easy to read, and you will be amazed at what you can do with it.

II. Adding Stress to S.A.M.'s Speech

In the phonetic mode, S.A.M. is capable of speaking with a great deal of inflection and emphasis. This gives a much more natural and understandable quality to the speech than is otherwise possible.

The stress system for S.A.M. is particularly easy to use. There are eight stress markers that can be used simply by inserting a number (1-8) *after* the vowel to be stressed. For example, the monotonic pronunciation of the word "hello" produced by the phonetic spelling "/HEHLOW" becomes a much friendlier sounding greeting when spelled "/HEH3LOW."

Why do *you* have to put in the stress markers? Simply because they can go *anywhere* and S.A.M. has no way of knowing where you *want* them to go. The following simple example will demonstrate this point to you. Use the SAYIT program on your S.A.M. disk to hear the following sample phrases.

We will have S.A.M. say

"Why should I walk to the store?"

in a number of different ways.

1. WAY2 SHUH7D AY WAO5K TUX DHAH STOH5R.
   (You want a reason to do it.)
2. WAY7 SHUH2D AY WAO7K TUX DHAH STOH5R.
   (You are reluctant to go.)
3. WAY5 SHUH7D AY2 WAO7K TUX DHAH STOHR.
   (You want someone else to do it.)
4. WAY5 SHUHD AY7 WAO2K TUX7 DHAH STOHR.
   (You'd rather drive.)
5. WAY5 SHUHD AY WAO5K TUX DHAH STOH2OH7R.
   (You want to walk somewhere else.)

Each of these stress examples has a slightly different meaning, even though the words are all the same. Stress markers give you the ability to let S.A.M. be expressive.

What do the stress markers do? The number you type tells S.A.M. to raise (or lower) his pitch and elongate the associated vowel sound.

The number system works like this:

1 = very emotional stress
2 = very emphatic stress
3 = rather strong stress
4 = ordinary stress
5 = light stress
6 = neutral (no pitch change) stress
7 = pitch-dropping stress
8 = extreme pitch-dropping stress

When should you use each of these? It all depends on how you want S.A.M. to sound. Say the words to yourself as expressively as you can and see where *your* voice rises and falls. Remember, the smaller the number, the more extreme the emphasis will be. Also, the stress markers will help get difficult words pronounced correctly. If some syllable is not enunciated sufficiently, put in a neutral stress marker.

A general rule is that the most important word or words in a sentence get the most stress and the rest of the words get little or no stress. However, words of more than one syllable should have stress marked on their accented syllables (most dictionaries show which these are if you are uncertain).

We will now assign stresses to our first example sentence about doing calculations on the computer. The first word "AY" is usually an important word (Can you think of anyone more important?). We will write it as "AY4," assigning ordinary stress. "DUW," the only verb, is also important. We'll try "DUW4." "MAY" isn't very strong (unless you want to draw attention to it), and it is a single syllable, so we will leave it alone. "KAELKYUWLEYSHUNZ" is polysyllabic so we *must* identify the accented syllables. It is also the most important word in the sentence so it will have the strongest stress. "LEY" has the primary stress and "KAEL" receives the secondary stress, so we will write "KAE4LKYUWLEY3SHUNZ." "AAN" and "DHAX" are short, unstressed words. "KUMPYUWTER" has a single accent on "PYUW" and gets written "KUMPYUW4TER." So, our original sentence gets written

AY4 DUW4 MAY KAE4LKYUWLEY3SHUNZ AAN DHAH KUMPYUW4TER.

Try typing it into the SAYIT program compared to the unstressed version.

How about really unusual stress? When you place extraordinary emphasis on a word, you do so by elongating its vowel sounds. S.A.M. can do the same thing. For example, a call for help can become "/HEH5EH4EH3EH2EH2EH3EH4EH5EHLP." You can always do this with the ordinary vowel sounds, but be careful with the diphthongs. They are complex sounds and if you repeat them, they will not do what you want (*e.g.* "OYOYOYOYOYOY" sounds just like it reads in English). To extend the diphthong sounds, you need to break them into component parts. So "OY" can be extended with "OHOHIYIYIY," and "AY" can be extended with "AAAAIYIYIY." You should experiment to find out just what you can do.

Unlike many other speech synthesis systems, S.A.M. allows you to control consonant stresses directly. This is usually done to produce a special tonal pattern in a word. Sometimes you might want a pitch rise on the final phoneme occurring just before a comma. For example, try typing: "AY4 YUWZ SAE5M3, AE4ND RIYSAY4TER." Notice how the pitch rises on the "M." It is never necessary to specify stress for a consonant occurring immediately before a stressed vowel. This is handled automatically.

Try to become familiar with the stress marker system. It makes all the difference between an ordinary speech synthesizer and the very expressive S.A.M.

III. The Effects of Punctuation

S.A.M. understands four punctuation marks. They are the hyphen, comma, period and question mark.

The hyphen (-) serves to mark clause boundaries by inserting a short pause in the speech. It also has other uses to be discussed later. The comma marks phrase boundaries and inserts a pause approximately double that of the hyphen. The question mark and period mark the end of sentences. The period inserts a pause and also causes the pitch to fall. The question mark also inserts a pause, but it causes the pitch to rise. Notice that not all questions should end with a question mark (rising pitch), only those that requires a yes-or-no answer. ("Are we hiking today?" rises; "Why are we going to the woods?" falls at the end and should be marked with a period.)

IV. Final Notes on Phonetic Input

S.A.M. is capable of speaking only 2.5 seconds of speech without a break (that is the size of his "breath"). If the string to be spoken exceeds this, S.A.M. will insert short breaks every 2.5 seconds. S.A.M. *always* breaks at punctuation marks in anticipation of the following phrase. So, if you don't like where S.A.M. broke up a phrase, you can specify your own breaks with hypens. An example of this is: "I use the telephone - to call out of town."

S.A.M. uses the spaces between words to make his sentence-breaking decisions. If a single word requires more than 2.5 seconds to say, S.A.M. will not be able to insert his own breaks and will therefore be unable to say the word.

In summary, the procedures outlined above may seem complex, but this is because they were presented in fine detail. In reality, the steps become automatic, and you will soon be able to type in phonetics almost as fast as you can type English text.

The Use of Pitch and Speed Controls

S.A.M. is capable of speaking in a wide range of tones and at many different rates. Both pitch and speed controls are accessed by single POKES to memory locations.

The following chart shows the effects of different values in the pitch and speed registers.*

PITCH

]PITCH N

N =

00-20	impractical
20-30	very high
30-40	high
40-50	high normal
50-70	normal
70-80	low normal
80-90	low
90-255	very low

default = 64

SPEED

]SPEED M

M =

0-20	impractical
20-40	very fast
40-60	fast
60-70	fast conversational
70-75	normal conversational
75-90	narrative
90-100	slow
100-225	very slow

default = 72

*See the memory reference chart for these locations.

What Am I Hearing?

In recent years, many new speech synthesizers have appeared in the marketplace. The techniques they use vary widely depending on the intended application. Most synthesizers found in consumer products, such as talking televisions or microwave ovens, use a "speech compression" technique of one sort or another. These techniques require a person to speak the needed words or entire sentences. The speech waveform is then "compressed" using a mathematical algorithm and, as a result, can then be stored in a memory chip without taking up a lot of room. The synthesizer's job is to then take this compressed speech information and expand it back into the original waveform. Some of these systems work quite well, retaining the speaker's intonation and sometimes even his or her identity. The processes used in such synthesizers differ greatly from those used in unlimited vocabulary synthesizers like S.A.M.

Let's follow the evolution of an unlimited vocabulary speech synthesizer. First, we must define the task. Simply, we want to create a system that will synthesize any English utterance. One way to begin would be to record every possible utterance on tape and just play back the right one whenever we need it. This would take up more tape or computer memory than could ever exist, so this method is obviously not too practical.

The next method might be to record all the English words and play them back in a specific order to create sentences. This is certainly practical. It would take up a large amount of memory, but it would work. However, we have lost something in this process. The words now sound disjointed because we have "spliced" the sentence together. Also, the stress or inflection pattern of the sentence is either wrong or non-existent. If we wanted an accurate stress pattern, we would need to record every word in a number of different styles, at different pitches, etc.

Such a system needs too much memory. So, let's break things down even further and try to store as little as possible in memory. Instead of storing sentences or words or even syllables, we could store phonemes. Phonemes are the atoms of spoken language, the individual speech sounds. It turns out that English has a little over 40 of them. Wow—this takes up practically no memory at all! We could specify the phonemes in the order we need to create words and sentences and really have ourselves a system. So, we go and record the phonemes and play them back to say the sentence, "I am a computer." Why can we barely understand it? It seems we have broken things down a bit too far. When we chop the words down to this level and then try to reassemble them, everything that blends one sound into another is lost and the results are nothing less than horrible.

But all is not lost. Our efforts are not wasted because we have the acoustic-phonetician to come to our rescue. These people deal in the study of speech sounds, and they can tell us just how to repair our phoneme-based system. First, instead of recording the actual speech waveform, we only store the frequency spectrums. By doing this, we save memory and pick up other advantages. Second, we learn that we need to store some data about timing. These are numbers pertaining to the duration of each phoneme under different circumstances, and also some data on transition times so we can know how to blend a phoneme into its neighbors. Third, we devise a system of rules to deal with all this data and, much to our amazement, our computer is babbling in no time.

9. **]ERROR** Beeps twice when you input a phoneme string to S.A.M. and a phoneme spelling error is detected. To find out where the error occurred, use the]ERROR command. The command will print out the phoneme string with the improper character in inverse video. If no error is detected, the]ERROR command has no effect.

10. **]QUIT** Removes the S.A.M. Wedge thereby allowing you to maximize free memory or use other conflicting wedges. To learn how to free up this additional memory, see the section on MEMORY USAGE.

Wedge commands 2-10 may be abbreviated by the use of the first two or more letters in the command (*i.e.*]PITCH-->]PI).

Programmers should note that Wedge commands require the following syntax in IF-THEN statements:

```
10 IF A$ = "YES" THEN: SAY "VERY GOOD."
```

rather than

```
10 IF A$ = "YES" THEN SAY "VERY GOOD."
```

The colon after THEN is required.

The S.A.M. Wedge is compatible with the DOS Wedge (DOS 5.1); if RECITER is used, be sure it is loaded into low memory.

Using KNOBS

KNOBS is a feature of S.A.M. that allows the use of two extra "control knobs" for S.A.M.'s voice. If we make rough analogies to the physical structures that produce speech, these KNOBS allow us to adjust the size of S.A.M.'s throat and his mouth. Doing this creates different voices without altering the pitch or speed of the speech (and, of course, you can still do these things independently with S.A.M.).

To use KNOBS in your program, simply issue the command]KNOBS n,m where n and m are numbers between 0 and 255. A value of 128 in each register results in S.A.M.'s normal voice. Using higher numbers dilates the throat or mouth. Experiment with different combinations of values and see what different voices you can get.

Here are a few sample voices to use from KNOBS:

Description	Speed	Pitch	Throat	Mouth
Elf	72	64	110	160
Little Robot	92	60	190	190
Stuffy Guy	82	72	110	105
Little Old Lady	82	32	145	145
Extra-Terrestrial	100	64	150	200
S.A.M.	72	64	128	128

Example: To have S.A.M. talk like an extra-terrestrial with English text input, use the following little program:

```
10 ]RECITER
20 ]SPEED 100
30 ]PITCH 64
40 ]KNOBS 150,200
50 SAY "I NEED TO PHONE HOME."
```


The RECITER Program

RECITER is an English text-to-speech program that converts ordinary text into phonemes that S.A.M. can understand. You simply supply output strings of 255 characters or less to the program. RECITER takes care of the rest.

The program uses about 450 rules to convert English into S.A.M.'s phonetic language. Included among these rules are some stress markers for situations where the stress choice is unambiguous. In addition, S.A.M.'s usual punctuation rules still operate with some additional symbols ("!", ";" and ":") being considered as periods. The net result is that even directly-translated English text has a fair amount of inflection.

RECITER also recognizes a number of special characters. Numbers are read aloud, and several others are pronounced as well. If a character is not understood by RECITER, it simply isn't passed to S.A.M.

We recommend use of RECITER (or any text-to-speech program, for that matter) only for applications where the user has no control of the text. For example, text already in a file, text received over a MODEM and text supplied by users unfamiliar with the phonetic system. Where the highest quality speech with full inflection is desired, we urge you to use S.A.M.'s phonetic system.

Don't be discouraged though. You will find that RECITER will do a better job of speaking from English text than other text-translator products.

The advan[illegible]s in synthesizing speech in this way are tremendous. We use very little memory fo[illegible]the data and the rules to use that data, and we also gain the ability to specify inflection, timing and intonation. This is because we have not stored actual speech sounds, only their spectrums. (You can think of this as a printer needing only four colors of ink to reproduce all the colors in a picture.)

Now, in actuality, we do not store all the spectrums, but only those that are targets. Each phoneme has associated with it a target spectrum which can be specified with very little data. The target may be thought of as a "frozen" speech sound, the sound you would be making if your mouth was frozen exactly in the middle of pronouncing the phoneme. The timing rules tell the synthesizer how to move from target to target in a manner that imitates the timing of a human talker.

S.A.M. is this type of synthesizer implemented entirely in software. It has the tables of phoneme spectra and timing, together with the rules for using this data to blend the sounds together into any English utterance we may have in mind. We have traded some quality from the method using all the recorded words, but what we have gained is versatility, practicality and the ability to do it all in real time, with very little memory usage, on an inexpensive microcomputer.

English-to-Phonetic Spelling Dictionary

A

abandon = AHBAE4NDUN
ability = AHBIH4LIXTIY
able = EY4BUL
abort = AHBOH4RT
about = AHBAW4T
above = AHBAH4V
absolute = AE5BSOHLUW4T
abuse = AHBYUW4S
accelerate = EHKSEH4LEREYT
accent = AE4KSEHNT
accept = AEKSEH4PT
access = AE4KSEHS
accident = AE4KSIXDEHNT
account = AHKAW4NT
acknowledge = EHKNAA4LIHJ
action = AE4KSHUN
active = AE4KTIHV
address = AE4DREHS
adjust = AHJAH4ST
adult = AHDAH4LT
advance = EHDVAE4NS
adventure = AEDVEH4NCHER
affair = AHFEY4R
afford = AHFOH4RD
after = AE4FTER
age = EY4J
agree = AHGRIY4
air = EH4R
airplane = EH4RPLEYN
alarm = AHLAA4RM
algebra = AE4LJAXBRAH
alien = EY4LIYIXN
allow = AHLAW4
alone = AHLOW4N
along = AHLAO4NX
alphabet = AE4LFAXBEHT
alternate = AO4LTERNIXT
America = AHMEH4RIXKAH
among = AHMAH4NX
analysis = AHNAE4LIXSIXS
and = AE4ND
anger = AE4NXGER
announce = AHNAW4NS
answer = AE4NSER
antenna = AENTEH4NAH
anticipate = AENTIH4SIXPEYT
apology = AHPAA4LAXJIY
appear = AHPIY4R
apple = AE4PUL
appropriate = AHPROH4PRIYIXT
approve = AHPRUW4V
area = EH4RIYAH
arm = AA4RM
arrive = AHRAY4V
ask = AE4SK
assumption = AHSAH4MPSHUN
astronomy = AHSTRAA4NUMIY
Atari = AHTAA4RIY
atom = AE4TUM
attack = AHTAE4K
audio = AO4DIYOW
authority = AHTHOH4RIXTIY
automatic = AO5TUMAE4TIXK
auxiliary = AOKZIH4LYERIY
available = AHVEH4LAXBUL

B

baby = BEY4BIY
back = BAE4K
bad = BAE4D
balance = BAE4LIXNS
bank = BAE4NXK
bargain = BAA4RGUN
base = BEY4S
basic = BEY4SIHK
battle = BAE4TUL
beam = BIY4M
beautiful = BYUW4TIXFUHL
behave = BIY/HEY4V
belief = BIXLIY4F
beneficial = BEH4NAXFIH4SHUL
betray = BIYTREY4
better = BEH4TER
bible = BAY4BUL
bibliography = BIH5BLIYAA4GRAXFIY
bicycle = BAY4SIXKUL
billion = BIH4LYUN
binary = BAY4NEHRIY
bite = BAY4T
black = BLAE4K
blast = BLAE4ST
block = BLAA4K
blood = BLAH4D
board = BOH4RD
bomb = BAA4M
book = BUH4K
boot = BUW4T
boss = BAO4S
bottle = BAA4TUL
bottom = BAA4TUM
box = BAA4KS
boy = BOY4
brain = BREY4N

branch = BR[illegible]ICH
break = BREY4N
brief = BRIY4F
bring = BRIH4NX
broken = BROW4KIXN
brother = BRAH4DHER
budget = BAH4JIXT
buffer = BAH4FER
bug = BAH4G
bureau = BYER4OW
burglar = BER4GULER
bus = BAH4S
business = BIH4ZNIXS
busy = BIH4ZIY
by = BAY4
byte = BAY4T

C

cabinet = KAE4BUNIXT
cable = KEY4BUL
calculate = KAE4LKYAXLEYT
calendar = KAE4LUNDER
call = KAO4L
calorie = KAE4LERIY
cancel = KAE4NSUL
candy = KAE4NDIY
can't = KAE4NT
capacity = KAXPAE4SIXTIY
captain = KAE4PTIXN
capture = KAE4PCHER
card = KAA4RD
careful = KEH4RFUHL
carry = KEH4RIY
cartridge = KAA4RTRIXJ
case = KEY4S
cashier = KAE4SHIY4R
cassette = KAXSEH4T
catalog = KAE4TULAOG
celebrate = SEH4LAXBREYT
celestial = SULEH4SCHIYUL
Celsius = SEH4LSIYAXS
center = SEH4NTER
certain = SER4TQN
challenge = CHAE4LIXNJ
change = CHEY4NJ
channel = CHAE4NUL
chapter = CHAE4PTER
charge = CHAA4RJ
chauvinism = SHOH4VIXNIHZUM
cheap = CHIY4P
cheese = CHIY4Z
child = CHAY4LD
children = CHIH4LDRIXN
chocolate = CHAO4KLIXT
choreography = KOH5RIYAA4GRAXFIY
Christmas = KRIH4SMAXS
church = CHER4CH
cinema = SIH4NUMAH
circle = SER4KUL
circuit = SER4KIXT
circumstance = SER4KUMSTAENS
citizen = SIH4TIXSUN
city = SIH4TIY
classify = KLAE4SIXFAY
clear = KLIY4R
close = KLOW4Z
coaxial = KOHAE4KSIYUL
coffee = KAO4FIY
coherent = KOW/HEH4RIXNT
cold = KOW4LD
college = KAA4LIXJ
color = KAH4LER
comfortable = KAH4MFTERBUL
Commodore = KAA4MAHDOHR
common = KAA4MUN
company = KAHM4PUNIY
complain = KUMPLEY4N
complex = KUMPLEH4KS
component = KAHMPOH4NUNT
computer = KUMPYUW4TER
condition = KUNDIH4SHUN
conscience = KAA4NSHUNTS
console = KAA4NSOHL
control = KUNTROH4L
conversation = KAA5NVERSEY4SHUN
coordinate = KOHWOH4DUNIXT
corporation = KOH5RPEREY4SHUN
correction = KOHREH4KSHUN
count = KAW4NT
country = KAH4NTRIY
cousin = KAH4ZIXN
create = KRIYEY4T
critical = KRIH4TIXKUL
culture = KAH4LCHER
curious = KYUH4RIYAXS

D

danger = DEY4NJER
data = DEY4TAH
decay = DIXKEY4
decide = DIXSAY4D
decibel = DEH4SIXBUL
decrease = DIYKRIY4S
definition = DEH5FUNIH4SHUN
degree = DIXGRIY4
delay = DIXLEY4
demonstrate = DEH4MUNSTREYT
department = DIYPAA4RTMIXNT
desire = DIXZAY4ER
develop = DIXVEH4LAHP
dictionary = DIH4KSHUNEHRIY
different = DIH4FRIXNT
discount = DIH4SKAWNT
distance = DIH4STIXNS
distribution = DIH5STRAXBYUW4SHUN
division = DIXVIH4ZHUN
doctor = DAA4KTER
double = DAH4BUL
down = DAW4N
drive = DRAY4V
dungeon = DAH4NJUN

E

earth = ER4TH
easy = IY4ZIY
economics = IY5KUNAA4MIXKS
education = EH5JUWKEY4SHUN
either = IY4DHER
eject = IXJEH4KT
electricity = ULEHKTRIH4SIXTIY
electronic = ULEHKTRAA4NIXK
elementary = EH4LUMEH4NTRIY
emphasis = EH4MFAXSIHS
encyclopedia = EHNSAY5KLAXPIY4DIYAH
energy = EH4NERJIY
engineering = EH5NJUNIY4RIHNX
enter = EH4NTER
enunciate = IYNAH4NSIYEYT
equal = IY4KWUL
erase = IXREY4S
error = EH4ROHR
escape = EHSKEY4P
estimate = EH4STUMIXT
Europe = YUH4RAXP
evil = IY4VUL
exciting = EHKSAY4TIHNX
explain = EHKSPLEY4N
expression = EHKSPREH4SHUN
extra = EH4KSTRAH

F

face = FEY4S
fail = FEY4L
Fahrenheit = FEH4RIXN/HAYT
false = FAO4LS
family = FAE4MULIY
fast = FAE4ST
fatal = FEY4TUL
father = FAA4DHER
fault = FAO4LT
female = FIY4MEYL
flight = FAY4T
figure = FIH4GYER
file = FAY4L
filter = FIH4LTER6
finance = FAY4NAENS
find = FAY4ND
finger = FIH4NXGER
finish = FIH4NIXSH
fire = FAY4ER
first = FER4ST
flavor = FLEY4VER
fight = FLAY4T
flow chart = FLOW4CHAART
flower = FLAW4ER
fluorescent = FLUHREH4SIXNT
focus = FOW4KAXS
follow = FAA4LOW
foot = FUH5T
force = FOH4RS
formula = FOH4RMYUXLAH
forward = FOH4RWERD
fraction = FRAE4KSHUN
fragile = FRAE4JUL
freedom = FRIY4DUM
frequency = FRIY4KWUNSIY
from = FRAH4M
fuel = FYUW4L
full = FUH4L
function = FAH4NXKSHUN
fundamental = FAH5NDUMEH4NTUL
fuse = FYUW4Z
fusion = FYUWSZHUN
future = FYUW4CHER

G

gain = GEY4N
galaxy = GAE4LAXKSIY
game = GEY4M
garbage = GAA4RBIXJ
gasoline = GAE4SULIYN
gate = GEY4T
general = JEH4NERUL
generate = JEH4NEREYT
genius = JIY4NYAXS
gentle = JEH4NTUL
genuine = JEH4NUYXIXN
geometry = JIYAA4MIXTRIY
get = GEH4T
giant = JAY4IXNT
gift = GIH4FT
glass = GLAE4S
gnome = NOW4M
go = GOW4
gold = GOH4LD
good = GUH4D
gourmet = GUHRMEY4
government = GAH4VERNMEHNT
grand = GRAE4ND
graphic = GRAE4FIXK

gravity = GRAI KTIY
ground = GRA D
guarantee = GAE4RIXNTIY4
guide = GAY4D
gun = GAH4N
gyroscope = JAY4RAXSKOWP

H

habit = /HAE4BIXT
hacker = /HAE4KER
hair = /HEH4R
half = /HAE4F
hallucination = /HULUW4SIXNEY5SHUN
hand = /HAE4ND
happy = /HAE4PIY
hardware = /HAA4RDWEHR
harmony = /HAA4RMUNIY
have = /HAE4V
head = /HEH4D
heart = /HAA4RT
helicopter = /HEH4LIXKAAPTER
hello = /HEH4LOW
here = /HIY4R
hero = /HIY4ROW
herta = /HER4TS
hesitate = /HEH4ZIXTEY6T
hexadecimal = /HEH5KSIXDEH4SUMUL
high = /HAY4
history = /HIH4STERIY
hobby = /HAA4BIY
hold = /HOW4LD
home = /HOW4M
honest = AA4NIXST
horoscope = /HOH4RAXSKOWP
hospital = /HAA4SPIXTUL
hour = AW4ER
house = /HAW4S
however = /HAWEH4VER
huge = /HYUW4J
human = /HYUW4MUN
humor = /HUYW4MER
husband = /HAH4ZBUND
hyper = /HAY4PER
hypothesis = /HAYPAA4THAXSIHS

I

I = AY4
ice = AY4S
idea = AYDIY4AX
identical = AYDEH4NTIXKUL
identity = AYDEH4NTIXTIY
illusion = IHLUX4ZHUN
image = IH4MIXJ
imagination = IHMAE4JIXNEY5SHUN
immobilize = IXMOH4BULAYZ
important = IHMPOH4RTUNT
in = IH4N
inch = IHN4CH
included = IHNKLUX4DIXD
income = IH4NKUM
inconvenient = IHN5KUNVIY4NYUNT
increase = IHNKRIY4S
indeed = IHNDIY4D
index = IH4NDEHKS
indicate = IH4NDIXKEYT
indirect = IH5NDEREH4KT
individual = IH5NDIXVIH4JUWUL
industry = IH4NDAHSTRIY
inferior = IHNFIH4RIYER
inflation = IHNFLEY4SHUN
influence = IH4NFLUWIXNS
information = IH5NFERMEY4SHUN
-ing = IHNX
inject = IHNJEH4KT
injure = IH4NJER
initial = IXNIH4SHUL
inside = IHNSAY4D
inspect = IHNSPEH4KT
insulator = IH4NSULEYTER
integer = IH4NTIXJER
intelligent = IHNTEH4LIXJIXNT
interest = IH4NTREHST
interference = IH4NTERFIY4RIXNS
intermittent = IH4NTERMIH4TNNT
invader = IHNVEY4DER
invent = IHNVEH4NT
inverse = IH4NVERS
involve = IHNVAA4LV
iron = AY4ERN
irrational = IHRAE4SHUNUL
isolate = AY4SULEYT
issue = IH4SHUW
item = AY4TUM

J

jacket = JAE4KIXT
jam = JAE4M
jargon = JAA4RGUN
jazz = JAE4Z
jiffy = JIH4FIY
job = JAA4B
join = JOY4N
joke = JOW4K
judge = JAH4J
jump = JAH4MP
junction = JAH4NXKSHUN
junior = JUW4NYER
just = JAH4ST
jail = JEY4L
jewelry = JUW4LRIY
journey = JER4NIY
jungle = JAH4NXGUL
junk = JAH4NXK

K

keep = KIY4P
key = KIY4
keyboard = KIY4BOHRD
kilobyte = KIH4LAXBAYT
kind = KAY4ND
kingdom = KIH4NXGDUM
knight = NAY4T
knowledge = NAA4LIXJ

L

label = LEY4BUL
lady = LEY4DIY
language = LAE4NXGWIXJ
large = LAA4RJ
laser = LEY4ZER
last = LAE4ST
late = LEY4T
laugh = LAE4F
launch = LAO4NCH
law = LAO4
layer = LEY4ER
lead = LIY4D
lease = LIY4S
lecture = LEH4KCHER
left = LEH4FT
legal = LIY4GUL
legend = LEH4JIXND
leisure = LIY4ZHER
length = LEH4NTH
letter = LEH4TER
level = LEH4VUL
liberal = LIH4BERUL
life = LAY4F
lift = LIH4FT
light = LAY4T
like = LAY4K
limit = LIH4MIXT
linear = LIH4NIYER
liquid = LIH4KWIXD
list = LIH4ST
listen = LIH4SIXN
literature = LIH4TERIXCHER
little = LIH4TUL
load = LOW4D
local = LOW4KUL
location = LOWKEY4SHUN
lock = LAA4K
logarithm = LAO4GERIH5DHUM
logical = LAA4JIHKUL
long = LAO4NX
look = LUH4K
loop = LUW4P
lose = LOW4Z
love = LAH4V
low = LOW4
loyal = LOY4UL
luminescence = LUW4MIXNEH5SIXNS
lunatic = LUW4NAXTIH6K
luxury = LAH4GZHERIY

M

machine = MAXSHIY4N
madam = MAE4DUM
made = MEY4D
magazine = MAEGAXZIY4N
magic = MAE4JIHK
magnet = MAE4GNIXT
magnitude = MAE4GNIHTUX5D
mail = MEY4L
main = MEY4N
major = MEY4JER
make = MEY4K
malfunction = MAE5LFAH4NXKSHUN
man = MAE4N
manager = MAE4NIXJER
maneuver = MUNUW4VER
manipulate = MUNIH4PYUHLEYT
manual = MAE4NYUWUL
manufacture = MAE5NUYXFAE4KCHER
many = MEH4NIY
marginal = MAA4RJIXNUL
market = MAA4RKIXT
marriage = MEH4RIXJ
mass = MAE4S
master = MAE4STER
mate = MEY4T
material = MAXTIH4RIYUL
mathematics = MAE4THUMAE5TIXKS
mature = MAXCHUX4R
maximum = MAE4KSIXMUM
may = MEY4
meaning = MUY4NIHNX
measure = MEH4ZHER
mechanical = MIXKAE4NIHKUL
mechanism = MEH4KUNIHZUM
media = MIY4DIYAH
medical = MEH4DIXKUL
medium = MIY4DIYUM
member = MEH4MBER
memory = MEH4MERIY
mental = MEH4NTUL
menu = MEH4NYUW
merchandise = MER4CHUNDAY5S
merge = MER4J

metal = MEH L
meter = MIY4 R
method = MEH4THIXD
micro = MAY4KROW6
middle = MIH4DUL
might = MAY4T
mile = MAY4L
military = MIH4LIXTEH6RIY
million = MIH4LYUN
mind = MAY4ND
mineral = MIH4NERUL
miniature = MIH4NIYAXCHER
minimum = MIH4NIXMUM
minus = MAY4NIXS
miracle = MIH4RIXKUL
miscellaneous = MIH5SULEY4NIYAXS
missile = MIH4SUL
mister = MIH4STER
mixture = MIH4KSCHER
mnemonic = NIXMAA4NIXK
model = MAA4DUL
modulation = MAA4JULEY5SHUN
molecule = MAA4LIXKYUWL
moment = MOH4MIXNT
money = MAH4NIY
monitor = MAA4NIXTER
monolithic = MAANULIH4THIXK
monotone = MAA4NAXTOW6N
month = MAH4NTH
moon = MUW4N
morning = MOH4RNIHNX
most = MOW4ST
mother = MAH4DHER
motion = MOW4SHUN
motor = MOW4TER
mouth = MAW4TH
move = MUW4V
much = MAH4CH
multiply = MAH4LTIX6PLAY
murder = MER4DER
muscle = MAH4SUL
music = MYUW4ZIXK
must = MAH4ST
my = MAY4
myself = MAYSEH4LF
mystery = MIH4STERIY

N

naive = NAY5IY4V
name = NEY4M
narrate = NAE4REYT
narrow = NAE4ROW
natural = NAE4CHERUL
nature = NEY4CHER
navigate = NAE4VIXGEYT
near = NIY4R
need = NIY4D
negative = NEH5GAXTIH6V
negotiate = NIXGOW4SHIYEYT
neighborhood = NEY4BER/HUH6D
nerve = NER4V
neutral = NUX4TRUL
news = NUW4Z
nice = NAY4S
night = NAY4T
noise = NOY4Z
nomenclature = NOH4MIXNKLEY6CHER
none = NAH4N
normal = NOH4RMUL
north = NOH4RTH
nose = NOW4Z
notation = NOHTEY4SHUN
notice = NOW4TIXS
nothing = NAH4THIHNX
now = NAW4
nuclear = NUX4KLIYER
number = NAH4MBER

O

object = AA4BJEHKT
obligation = AA5BLIXGEY4SHUN
observe = AXBZER4V
obvious = AA4BVIYAXS
occasional = AHKEY4ZHUNUL
occupation = AA5KYUXPEY4SHUN
ocean = OW4SHUN
odd = AA4D
of = AH4V
off = AO4F
offer = AO4FER
office = AO4FIXS
official = AHFIH4SHUL
ogre = OW4GER
ohm = OW4M
oil = OY4L
O.K. = OW4KEY
old = OW4LD
omen = OW4MUN
on = AA4N
open = OW4PUN
operate = AA4PEREYT
opinion = AHPIH4NYUN
oppose = AHPOW4Z
opposite = AA4PAXSIHT
option = AA4PSHUN
orbit = OH4RBIHT
orchestra = OH4RKEHSTRAH
order = OH4RDER
ordinary = OH4RDIXNEHRIY
organize = OH4GUNAYZ
origin = OH4RIXJIXN

oscillation = AA5SULEY4SHUN
other = AH4DHER
ought = AO4T
out = AW4T
outlet = AW4TLEHT
output = AW4TPUHT
outside = AWTSAY4D
over = OW4VER
own = OW4N
oxygen = AA4KSAXJIXN

P

pack = PAEPAE4K
package = PAE4KIXJ
page = PEY4J
paint = PEY4NT
pair = PEH4R
palace = PAE4LIXS
panel = PAE4NUL
paper = PEY4PER
parabola = PERAE4BULAH
paradox = PAE4RAXDAA6KS
parallel = PAE4RULEH6L
paragraph = PAE4RAXGRAEF
pardon = PAA4RDUN
parent = PEH4RUNT
parity = PAE4RIXTIY
park = PAA4RK
part = PAA4RT
particle = PAA4RTIXKUL
particular = PAARTIH4KYUHLER
pass = PAE4S
patch = PAE4TCH
pathetic = PAHTHEH4TIXK
pattern = PAE4TERN
pause = PAO4Z
pay = PEY4
payroll = PEY4ROW6L
peculiar = PIXKYUW4LYER
penalty = PEH4NULTIY4
penetrate = PEH4NAXTREY6T
perception = PERSEH4PSHUN
perfect = PER4FIXKT
period = PIH4RIYIXD
permanent = PER4MUNIXNT
permission = PERMIH4SHUN
person = PER4SUN
personality = PER4SUNAE5LIXTIY
perspective = PERSPEH4KTIXV
pet = PEH4T
phantom = FAE4NTUM
phase = FEY4Z
phenomenon = FUNAA4MIXNUN
philosophy = FULAA4SAHFIY
phoneme = FOW4NIYM
photo = FOW4TOW
physical = FIH4ZIXKUL
physics = FIH4ZIXKS
piano = PYAE4NOW
pick = PIH4K
picture = PIH4KCHER
pilot = PAY4LIXT
pin = PIH4N
pirate = PAY4RIXT
pistol = PIH4STUL
pitch = PIH4TCH
pity = PIH4TIY
place = PLEY4S
plan = PLAE4N
planet = PLAE4NIXT
plastic = PLAE4STIXK
plausible = PLAO4ZAXBUL
play = PLEY4
please = PLIY4Z
pleasure = PLEH4ZHER
plectrum = PLEH4KTRUM
plenty = PLEH4NTIY
plot = PLAA4T
plug = PLAH4G
plus = PLAH4S
poetry = POW4IXTRIY
point = POY4NT
poke = POW4K
police = PULIY4S
policy = PAA4LIXSIY
polynomial = PAA5LIXNOH4MIYUL
pop = PAA4P
popular = PAA4PYULER
population = PAA4PYULEY4SHUN
port = POH4RT
portable = POH4RTAXBUL
positive = PAA4ZIXTIX6V
position = PAXZIH4SHUN
power = PAW4ER
practice = PRAE4KTIHS
precise = PRIXSAY4S
prefer = PRIXFER4
preliminary = PREIXLIH4MIXNEHRIY
prepare = PRIXPEH4R
present = PREH4ZIXNT
press = PREH4S
pressure = PREH4SHER
prevent = PRIXVEH4NT
primary = PRAY4MEHRIY
primitive = PRIH4MIXTIX6V
prince = PRIH4NS
princess = PRIH4NSEHS
print = PRIH4NT
private = PRAY4VIXT
probably = PRAA4BAXBLIY

problem = PRA .UM
proceed = PROHSIY4D
process = PRAA4SEHS
produce = PRAXDUW4S
professional = PRAXFEH4SHUNUL
professor = PRAHFEH4SER
profit = PRAA4FIXT
program = PROW4GRAEM
project = PRAA4JEHKT
promise = PRAA4MIHS
pronounce = PRUNAW4NS
proper = PRAA4PER
proportional = PRAXPOH4RSHUNUL
protect = PRAXTEH4KT
proud = PRAW4D
psychiatrist = SAYKAY4AXTRIX6ST
public = PAH4BLIXK
publish = PAH4BLIHSH
pull = PUH4L
pulse = PAH4LS
pure = PYUW4R
push = PUH4SH
put = PUH4T

Q

quality = KWAA4LIXTIY
quantity = KWAA4NTIXTIY
question = KWEH4SCHUN
quick = KWIH4K
quiet = KWAY4IXT
quit = KWIH4T
quiz = KWIH4Z
quote = KWOW4T
quotient = KWOW4SHUNT

R

race = REY4S
radar = REY4DAAR
radiation = REY5DIYEY4SHUN
radio = REY4DIYOW
radius = REY4DIYAHS
rain = REY4N
random = RAE4NDUM
range = REY4NJ
rare = REH4R
rate = REY4T
rather = RAE4DHER
ratio = REY4SHIYOW
reach = RIY4CH
reaction = RIYAE4KSHUN
read = RIY4D
realistic = RIY5LIH4STIXK
reason = RIY4ZUN
receive = RIXSIY4V
reciter = RIXSAY4TER
recognize = REH4KAXGNAYZ
recommend = REH5KUMEH4ND
record = REH4KERD
recover = RIYKAH4VER
rectangle = REH4KTAENXGUL
reduce = RIXDUW4S
refer = RIYFER4
reference = REH4FERIXNS
reflection = RIXFLEH4KSHUN
refrigerator = RIXFRIH4JEREYTER
region = RIY4JUN
register = REH4JIXSTER
regular = REH4GYUXLER
reject = RIXJEH4KT
relativity = REH5LAXTIH4VIXTIY
relax = RIXLAE4KS
relay = RIY4LEY
release = RIXLIY4S
relief = RIYLIY4F
religion = RIXLUH4JUN
remain = RIYMEY4N
remember = RIXMEH4MBER
remove = RIYMUX4V
rent = REH4NT
repeat = RIXPIY4T
replace = RIXPLEY4S
reply = RIXPLAY4
report = RIXPOH4RT
represent = REHPRIXZEH4NT
reproduction = RIY5PRAXDAH4KSHUN
republic = RIXPAH4BLIXK
rescue = REH4SKYUW
research = RIY4SERCH
reserve = RIXZER4V
resistance = RIXZIH4STUNS
respect = RIXSPEH4KT
response = RIXSPAA4NS
rest = REH4ST
restore = RIXSTOH4R
retail = RIY4TEY6L
return = RIXTER4N
reverse = RIXVER4S
review = RIXVYUW4
revolution = REH5VULUXWSHUN
rhapsody = RAE4PSAXDIY
rhythm = RIH4DHUM
rich = RIH4CH
ride = RAY4D
ridiculous = RIXDIH4KYULAXS
right = RAY4T
rigid = RIH4JIXD
ring = RIH4NX
rise = RAY4Z
river = RIH4VER
road = ROW4D
rocket = RAA4KIXT
roll = ROH4L
room = RUW4M
rough = RAH4F
round = RAW4ND
rubber = RAH4BER
rule = RUW4L
run = RAH4N
rush = RAH4SH

S

sabotage = SAE5BAXTAA6ZH
sacrifice = SAE4KRIXFAYS
sad = SAE4D
safe = SEY4F
safety = SEY4FTIY
saint = SEY4NT
sale = SEY4L
S.A.M. = SAE4M
same = SEY4M
sample = SAE4MPUL
sanctuary = SAE4NXKCHUWEH6RIY
sandwich = SAE4NWIXCH
sarcasm = SAA4RKAEZUM
satisfaction = SAE4TIXSFAE4KSHUN
savage = SAE4VIXJ
save = SEY4V
say = SEY4
scale = SKEY4L
scandal = SKAE4NDUL
scarce = SKEY4RS
scatter = SKAE4TER
scenic = SIY4NIXK
schedule = SKEH4JYUWL
scheme = SKIY4M
scholar = SKAA4LER
school = SKUW4L
science = SAY4IHNS
scientific = SAY4UNTIH5FIXK or
scientific = SAW4AXNTIH5FIXK
scissors = SIH4ZERZ
score = SKOH4R
scramble = SKRAE4MBUL
scratch = SKRAE4CH
scream = SKRIY4M
screw = SKRUW4
script = SKRIH4PT
scroll = SKROW4L
seal = SIY4L
search = SER4CH
season = SIY4ZUN
second = SEH4KUND
secret = SIY4KRIXT
secretary = SEH4KRIXTEH5RIY
section = SEH4KSHUN
security = SIXKYUH4RIXTIY
see = SIY4
seek = SIY4K
segment = SEH4GMIXNT
self = SEH4LF
sell = SEH4L
semi- = SEH4MIY
send = SEH4ND
sensation = SEHNSEY4SHUN
senior = SIY4NYER
sense = SEH4NS
sensible = SEH4NSIXBUL
sensitive = SEH4NSIXTIX6V
sentence = SEH4NTIXNS
separate = SEH4PERIXT
sequence = SIY4KWEHNS
serial = SIH4RIYUL
serious = SIH4RIYAHS
serve = SER4V
service = SER4VIXS
session = SEH4SHUN
set = SEH4T
settle = SEH4TUL
several = SEH4VERUL
sex = SEH4KS
shadow = SHAE4DOW
shake = SHEY4K
shame = SHEY4M
shape = SHEY4P
share = SHEY4R
sharp = SHAA4RP
she = SHIY4
sheet = SHIY4T
shield = SHIY4LD
shift = SHIH4FT
shock = SHAA4K
shoot = SHUW4T
shop = SHAA4P
short = SHOH4RT
should = SHUH4D
show = SHOW4
shy = SHAY4
sick = SIH4K
side = SAY4D
sight = SAY4T
sign = SAY4N
signal = SIH4GNUL
silent = SAY4LIXNT
silver = SIH4LVER
similar = SIH4MULER
simple = SIH4MPUL
simplicity = SIHMPLIH4SIXTIY
simulator = SIH4MYULEYTER
sin = SIH4N
single = SIH4NXGUL
sinister = SIH4NIXSTER
sir = SER4

siren = SAY4
sit = SIH4T
situation = SIH5CHUWEY4SHUN
skeptical = SKEH4PTIXKUL
sketch = SKEH4TCH
skill = SKIH4L
skip = SKIH4P
slang = SLAE4NX
sleep = SLIY4P
sleeve = SLIY4V
slip = SLIH4P
slot = SLAA4T
slow = SLOW4
small = SMAO4L
smart = SMAA4RT
smell = SMEH4L
smooth = SMUW4DH
snap = SNAE4P
so = SOW4
social = SOW4SHUL
society = SAXSAY4IXTIY
soft = SAO4FT
solar = SOW4LER
soldier = SOH4LJER
solemn = SAA4LUM
solid = SAA4LIXD
solitude = SAA4LIXTUW6D
solution = SULUW4SHUN
some = SAH4M
somebody = SAH4MBAADIY
song = SAO4NX
soon = SUW4N
sophisticated = SAXFIH4STIXKEYTIXD
sorry = SAA4RIY
sort = SOH4RT
sound = SAW4ND
south = SAW4TH
space = SPEY4S
spare = SPEY4R
spatial = SPEY4SHUL
speak = SPIY4K
special = SPEH4SHUL
specific = SPAXSIH4FIXK
speculate = SPEH4KYULEYT
speech = SPIY4CH
speed = SPIY4D
spell = SPEH4L
spend = SPEH4ND
sphere = SFIY4R
spin = SPIH4N
spiral = SPAY4RUL
spirit = SPIH4RIXT
splendid = SPLEH4NDIXD
split = SPLIH4T
spoil = SPOY4L
spontaneous = SPAANTEY4NIYAHS
sports = SPOH4RTS
spot = SPAA4T
spread = SPREH4D
spring = SPRIH4NX
spy = SPAY4
square = SKWEH4R
squeeze = SKWIY4Z
stability = STAXBIH4LIXTIY
staff = STAE4F
stand = STAE4ND
standard = STAE4NDERD
star = STAA4R
start = STAA4RT
state = STEY4T
static = STAE4TIXK
station = STEY4SHUN
stay = STEY4
steady = STEH4DIY
steer = STIY4R
step = STEH4P
stereo = STEH4RIYOW
stick = STIH4K
stimulate = STIH4MYULEYT
stock = STAA4K
stone = STOW4N
stop = STAA4P
store = STOH4R
story = STOH4RIY
straight = STREY4T
strange = STREY4NJ
strategy = STRAE4TIXJIY
street = STRIY4T
strength = STREY4NTH
strike = STRAY4K
strong = STRAO4NX
structure = STRAH4KCHER
stubborn = STAH4BERN
student = STUW4DIXNT
study = STAH4DIY
stuff = STAH4F
stupid = STUX4PIXD
style = STAY4L
subject = SAH4BJEHKT
substance = SAH4BSTIXNS
subtle = SAH4TUL
succession = SAHKSEH4SHUN
succeed = SAHKSIY4D
such = SAH4CH
sudden = SAH4DIXN
suggest = SAHGJEH4ST
sum = SAH4M
summer = SAH4MER
sun = SAH4N
super = SUX4PER
superb = SUXPER4B
superior = SUXPIH4RIYER
supply = SAXPLAY4
support = SAXPOH4RT

sure = SHUX4R
surprise = SERPRAY4Z
surroundings = SERAW4NDIHNXGZ
suspend = SAHSPEH4ND
swear = SWEH4R
sweep = SWIY4P
swell = SWEH4L
swing = SWIH4NX
syllable = SIH4LAXBUL
symbol = SIH4MBUL
symbolic = SIHMBAA4LIXK
symmetric = SIHMEH4TRIXK
sympathy = SIH4MPAXTHIY
synchronize = SIH4NXKRAX5NAYZ
synonym = SIH4NUNIXM
system = SIH4STUM
synthesizer = SIH4NTHAXSAYZER

T

tab = TAE4B
table = TEY4BUL
tactical = TAE4KTIXKUL
tail = TEY4L
take = TEY4K
talent = TAE4LIX6NT
tall = TAO4L
talk = TAO4K
tap = TAE4P
tape = TEY4P
target = TAA4RGIXT
task = TEY4ST
tax = TAE4KS
teach = TIY4CH
team = TIY4M
technical = TEH4KNIXKUL
technology = TEHKNAA4LAXJIY
telephone = TEH4LAX6FOWN
television = TEH4LAX6VIXZHUN
temper = TEH4MPER
tender = TEH4NDER
tense = TEH4NS
tension = TEH4NSHUN
term = TER4M
terminal = TER4MIXNUL
terrestrial = TER6EH4STRIY6UL
terrible = TEH4RAXBUL
territory = TEH4RAXTOH6RIY
terror = TEH4RER6
test = TEH4ST
testimony = TEH4STUMOHNIY
text = TEH4KST
than = DHAE4N
thank = THAE4NXK
that = DHAE4T
the = DHAH4
theater = THIY4AHTER
then = DHEH4N
theorem = THIY4RUM
theory = THIY4RIY
thermometer = THERMAA4MIXTER
thesis = THIY4SIXS
they = DHEY4
thin = THIH4N
thing = THIH4NX
think = THIH4NXK
this = DHIH4S
thought = THAO4T
threshold = THREH4SH/HOWLD
through = THRUW4
ticket = TIH4KIXT
tight = TAY4T
time = TAY4M
tiny = TAY4NIY
tired = TAY4ERD
title = TAY4TUL
together = TUXGEH4DHER
tolerance = TAA4LERIXNS
tone = TOW4N
tool = TUW4L
top = TAA4P
toss = TAO4S
touch = TAH4CH
tough = TAH4F
tournament = TER4NUMIXNT
toward = TOH4RD or
toward = TOW4RD
town = TAW4N
toy = TOY4
trace = TREY4S
track = TRAE4K
trade = TREY4D
tradition = TRAXDIH4SHUN
traffic = TRAE4FIXK
trail = TREY4L
trajectory = TRAXJEH4KTERY
transaction = TRAENZAE4KSHUN
transfer = TRAE4NSFER
transform = TRAENSFOH4RM
transistor = TRAENZIH4STER
translate = TRAE4NZLEYT
transmit = TRAE4NZMIXT
transparent = TRAE5NSPEH4RIXNT
transportation =
TRAE5NZPOHRTEY4SHUN
trap = TRAE4P
treasury = TREH4ZHERIY
tree = TRIY4
trek = TREH4K
tremendous = TRIXMEH4NDAXS
trespass = TREH4SPAES
trial = TRAY4UL
triangle = TRAY4AENXGUL

trick = TRIH
trigger = TR[illegible]ER
trim = TRIH4M
trip = TRIH4P
triple = TRIH4PUL
triumph = TRAY4AHMF
troll = TROW4L
trophy = TROW4FIY
trouble = TRAH4BUL
truck = TRAH4K
true = TRUW4
truth = TRUW4TH
try = TRAY4
tune = TUW4N
tunnel = TAH4NUL
turn = TER4N
tutor = TUW4TER
twist = TWIH4ST
type = TAY4P
typewriter = TAY4PRAYTER

U

ugly = AH4GLIY
ultimate = AH4LTAX6MIXT
uncle = AH4NKUL
under = AH4NDER
understand = AH5NDERSTAE4ND
uniform = YUW4NIXFOHRM
union = YUW4NYUN
unit = YUW4NIXT
universal = YUW5NIXVER4SUL
unless = AHNLEH4S
up = AH4P
upset = AHPSEH4T
urge = EH4RJ
use = YUW4S
utility = YUWTIH4LIXTIY

V

vacation = VEYKEY4SHUN
vacuum = VAE4KYUWM
vague = VEY4G
valid = VAE4LIXD
value = VAE4LYUW
valve = VAE4LV
vanadium = VUNEY4DIYUM
vapor = VEY4PER
variation = VEH5RIYEY4SHUN
various = VEH4RIYAHS
vary = VEH4RIY
veal = VIY4L
vector = VEH4KTER
vegetable = VEH4JTAXBUL
vehicle = VIY4IX6KUL
ventilate = VEH4NTULEYT
verb = VER4B
versatile = VER4SAXTUL
verse = VER4S
version = VER4ZHUN
vertical = VER4TIXKUL
very = VEH4RIY
veto = VIY4TOW
vibration = VAYBREY4SHUN
vicinity = VAXSIH4NIXTIY
victory = VIH4KTERIY
video = VIH4DIYOW
village = VIH4LIXJ
vinyl = VAY4NUL
violation = VAY4AXLEY5SHUN
virtue = VER4CHUW
visible = VIH4ZIXBUL
visit = VIH4ZIXT
vital = VAY4TUL
vocabulary = VOHKAE4BYULEHRIY
vocal = VOW4KUL
voice = VOY4S
volt = VOW4LT
volume = VAA4LYUWM
voluntary = VAA4LUNTEH5RIY
vote = VOW4T
vowel = VAW4UL
voyage = VOY4IXJ
video = VIH4DIYOW

W

wafer = WEY4FER
wage = WEY4J
wait = WEY4T
wake = WEY4K
walk = WAO4K
wall = WAO4L
war = WOH4R
warm = WOH4RM
warp = WOH4RP
warranty = WOH5RIXNTIY4
wash = WAA4SH
waste = WEY4ST
watch = WAA4CH
water = WAO4TER
watt = WAA4T
wave = WEY4V
way = WEY4
weak = WIY4K
wealth = WEH4LTH
wear = WEH4R
wedding = WEH4DIHNX
week = WIY4K
weight = WEY4
welcome = WEH4LKUM
well = WEH4L
were = WER4
what = WHAH4T
wheel = WHIY4L
when = WHEH4N
which = WHIH4CH
while = WHAY4L
whisper = WHIH4SPER
white = WHAY4T
who = /HUW4
whole = /HOW4L
wide = WAY4D
wild = WAY4LD
will = WIH4L
win = WIH4N
window = WIH4NDOW
wing = WIH4NX
winter = WIH4NTER
wise = WAY4Z
wish = WIH4SH
with = WIH4TH
wizard = WIH4ZERD
woman = WUH4MUN
women = WIH4MIXN
wonder = WAH4NDER
word = WER4D
Wordrace = WER2D REYS
work = WER4K
world = WUH4RLD
worry = WER4IY
would = WUH4D
wrap = RAE4P
write = RAY4T
wrong = RAO4NX

X

Xerox = ZIH4RAAKS
X-ray = EH4KSREY
xylophone = ZAY4LAXFOWN

Y

yacht = YAA4T
yard = YAA4RD
yawn = YAO4N
year = YIH4R
yellow = YEH4LOW
yes = YEH4S
you = YUW4
your = YOH4R
youth = YUX4TH

Z

zany = ZEY4NIY
zero = ZIY4ROW
zig-zag = ZIH3GZAEG
zip = ZIH4P
zodiac = ZOW4DIY6AEK
zone = ZOW4N

Days Of The We[illegible]

Monday = MAH4NDEY
Tuesday = TUW4ZDEY
Wednesday = WEH4NZDEY
Thursday = THER4ZDEY
Friday = FRAY4DEY
Saturday = SAE4TERDEY
Sunday = SAH4NDEY

Months Of The Year

January = JAE4NYUXEHRIY
February = FEH4BRUXEH6RIY
March = MAA4RCH
April = EY4PRIXL
May = MEY4
June = JUW4N
July = JUHLAY4
August = AO4GAXST
September = SEHPTEH4MBER
October = AAKTOW4BER
November = NOHVEH4MBER
December = DIHSEH4MBER

Numbers

one = WAH4N
two = TUW4
three = THRIY4
four = FOH4R
five = FAY4V
six = SIH4KS
seven = SEH4VIXN
eight = EY4T
nine = NAY4N
ten = TEH4N
eleven = IXLEH4VIXN
twelve = TWEH4LV
thirteen = THER4TIY6N
twenty = TWEH4NTIY
thirty = THER4TIY
hundred = /HAH4NDRIXD
thousand = THAW4ZUND
million = MIH4LYUN

States And Provinces

United States = YUWNAY4TIXD STEY4TS
Alabama = AE4LAXBAE6MAX
Alaska = AHLAE4SKAH
Arizona = EH4RAXZOW5NAH
Arkansas = AA4RKUNSAO
California = KAE5LAXFOH4RNYAH
Colorado = KAA5LAXRAA4DOW

Connecticut = KAHNEH4TIXKAHT
Delaware = DEH4LAXWEH6R
Florida = FLOH4RIXDAH
Georgia = JOH4RJAH
Hawaii = /HAHWAY4IY
Idaho = AY4DAH/HOW
Illinois = IHLUNOY4
Indiana = IH5NDIYAE4NAH
Iowa = AY4AHWAH
Kansas = KAE4NZIXS
Kentucky = KEHNTAH4KIY
Louisiana = LUXIY4ZIYAE5NAH
Maine = MEY4N
Maryland = MEH4RULIXND
Massachusetts = MAE5SAXCHUW4SIXTS
Michigan = MIH4SAXGUN
Minnesota = MIH5NAXSOW4TAH
Mississippi = MIH5SIXSIH4PIY
Missouri = MIHZUH4RIY
Montana = MAANTAE4NAH
Nebraska = NAXBRAE4SKAH
Nevada = NAXVAE4DAH
New Hampshire = NUW6/HAE4MPSHER
New Jersey = NUWJER4ZIY
New Mexico = NUWMEH4KSIXKOW
New York = NUWYOH4RK
North Carolina = NOH4RTH
KEH5RULAY4NAH
North Dakota = NOH4RTH DAHKOW4TAH
Ohio = OW/HAY4OW
Oklahoma = OWKLAX6/HOW4MAH
Oregon = OH4RIXGUN
Pennsylvania = PEH5NSULVEY4NYAH
Rhode Island = ROW5D AY4LUND
South Carolina = SAW4TH
KEH5RULAY4NAH
South Dakota = SAW4TH DAXKOW4TAH
Tennessee = TEH5NAXSIY4
Texas = TEH4KSAXS
Utah = YUW4TAO6
Vermont = VERMAA4NT
Virginia = VERJIH4NYAH
Washington = WAA4SHIHNXTAHN
West Virginia = WEH5ST VERJIH4NYAH
Wisconsin = WIHSKAA4NSUN
Wyoming = WAYOW4MIHNX

Provinces of Canada =
PRAA4VIXNSIXZ AHV KAE4NAXDAH

Alberta = AELBER4TAH
British Columbia =
BRIH4TIXSH KAHLAH4MBIYAH
Manitoba = MAE5NIXTOW4BAH
New Brunswick = NUWBRAH4NZWIXK
Newfoundland = NUW4FIXNLIXND
Nova Scotia = NOH4VAXSKOW4SHAH
Ontario = AANTEH4RIYOW
Prince Edward Island =
PRIH5NS EH4DWERD AY4LUND
Quebec = KUHBEH4K
Saskatchewan = SAESKAE4CHAXWAAN

Units

units = YUW4NIXTS
inches = IH4NCHIXZ
feet = FIY4T
yards = YAA4RDZ
miles = MAY4LZ
centimeters = SEH4NTIXMIY6TERZ
kilometers = KIXLAA4MIXTERZ
acres = EY4KERZ
ounces = AW4NSIXZ
pounds = PAW4NDZ
tons = TAH4NZ
grams = GRAE4MZ
teaspoons = TIY4SPUWNZ
cups = KAH4PS
pints = PAY4NTS
quarts = KWOH4RTS
gallons = GAE4LUNZ
liters = LIY4TERZ
degrees = DAXGRIY4Z

Using S.A.M. Without the S.A.M. Wedge

S.A.M. can be accessed in a number of different ways. The easiest way to use S.A.M. from Commodore BASIC is to use the S.A.M. Wedge. However, if (a) your application program requires large amount of RAM and you are running short of memory, or (b) execution speed is a premium consideration, or (c) you are trying to use another wedge that is not compatible with the S.A.M. Wedge, then you may wish to access S.A.M. in a more direct way.

Also, if your program requires parameters other than the speech text to be inputted by the user, wedge commands will not work for this purpose. The other parameters will need to be POKEed into S.A.M.'s registers.

Two BASIC statements are all that are required to make S.A.M. speak. The following statements inserted anywhere in a Commodore BASIC program will cause S.A.M. to say "I am a computer":

```
100 SA$ = "AY$ AEM AH KUMPYUW4TER."
110 SYS 39424
```

This way of accessing S.A.M. uses a reserved string variable name SA$ and a machine language call via the SYS command. The SA$ string can be generated by all the usual techniques including direct assignment, data statements, text files, etc. Like any other string, however, SA$ can be no longer than 255 characters.

To use RECITER directly, the same basic technique applies. Assign the desired English text to the string SA$ and execute a SYS command, this time

```
110 SYS 39430
```

In this mode of operation, S.A.M.'s special features are accessed with POKE commands. For example, pitch is controlled by POKEing the desired value into 39439 (*i.e.* 100 POKE 39439,73), speed is controlled by POKEing the desired value into 39438 and KNOBS requires two POKES for throat and mouth plus a SYS statement SYS 38882. The table on the following page summarizes all the memory locations needed for accessing S.A.M.'s features, as well as the command needed (POKE or SYS).

Using S.A.M. and RECITER from Machine Language

Machine language access to S.A.M. is similar to BASIC access without the wedge except that the programmer has to do the string handling. A string of ASCII characters (the same ones you would use in BASIC) is moved into locations $9A15-$9B14. The first character must be in $9A15 and the last character, a $9B return character, marks the end of the string. Bytes after the $9B are not read by S.A.M. After the string to be spoken is moved into S.A.M.'s buffer, simply execute a JSR $9A03 command, and S.A.M. will speak. If RECITER is installed and the string is English text, the command becomes JSR $9A09.

Screen Blank

The screen blanks during vocal output because Direct Memory Access (DMA) causes gaps to be inserted into the speech waveform each time the 6510 microprocessor waits for the VIC video chip to access memory. The audible result is a gravelly quality to the speech when the screen is left on.

The speech quality with the screen on is still quite understandable and you may wish to leave the display on in your program. To do so, simply issue the Wedge command]LIGHTS 1 or POKE the value 1 into the lights register, 39440 (the two commands are equivalent). To restore the screen blanking, issue a]LIGHTS 0 or a POKE 39440,0 command. The lights-on speech is somewhat slower than the blank screen speech; you may wish to speed up the voice to compensate.

S.A.M. shuts off the SPRITES when he speaks as well as turning off the system interrupts. It should therefore be noted that any timing will be affected by the speech. The use of SPRITES will degrade the speech in proportion to how many SPRITES are used.

Using the SAYIT Program

SAYIT is a BASIC program that allows you to try out all of S.A.M.'s features in a very simple way. When you run the program, it will prompt you with the word "SAY:". You can then type in whatever you want S.A.M. to say and he will say it. Simply hitting the RETURN key will cause S.A.M. to repeat his previous words.

If you want to use any of S.A.M.'s special features, press any of the special function keys (F1, F2, etc.), and you will be shown a menu of commands. Type the first letter of the command and SAYIT will ask you for whatever information it needs. The N command will set S.A.M.'s voice back to its standard quality (useful after you make lots of changes), and the E command will bring you back to the SAY: part of the program. Until you give the E command, you may continue to access the features of the SAYIT menu.

Memory Usage and S.A.M.

When you boot S.A.M. into your C64 computer and type PRINT FRE(0), you will notice that you have lost approximately 2.75K of RAM space. S.A.M. takes up approximately 10.75K of memory, so what happened to the other 8K? The majority of S.A.M. is hidden behind BASIC! However, it is possible to use even less memory with S.A.M. Here are a couple of things to do:

1. Type]QUIT:POKE 55,0:POKE 56,154
   This removes the S.A.M. Wedge and resets the High Memory Pointer to overwrite the KNOBS routine. This is the most stripped-down version of S.A.M. and uses only 1.5K of RAM. However, you will not have the Wedge or use of KNOBS. Also, don't make this change during a program as it will scramble memory.
2. RECITER can be loaded into two different places in memory. When it is loaded into low memory (just below the S.A.M. Wedge), it uses approximately 6K of RAM. This is in addition to the 2.75K RAM that S.A.M. uses. If you load RECITER into high memory, the majority of RECITER is placed into memory locations $COOO-$CFFF. This version takes up only 2K of RAM, but it might conflict with other programs and utilities that use the same space.

Important Addresses

	POKE/SYS?	DECIMAL	HEX
S.A.M. from BASIC	SYS	39424	$9A00
S.A.M. from machine lang.	JSR	39427	$9A03
RECITER from BASIC	SYS	39430	$9A06
RECITER from machine lang.	JSR	39433	$9A09
SPEED	POKE	39438	$9A0E
PITCH	POKE	39439	$9A0F
LIGHTS	POKE	39440	$9A10
INTERRUPTS (0 = no interrupts processed)	POKE	39441	$9A11
Reinstall S.A.M. WEDGE	SYS	38144	$9500
ASCII STRING	TEXT	39445	$9A15
Throat	POKE	38880	
Mouth	POKE	38881	

Seldom-Used Phoneme Combinations

Phoneme Combination	You probably want:	Unless it splits syllables like:
GS	GZ *e.g.* ba**gs**	bu**gs**pray
BS	BZ *e.g.* slo**bs**	**obs**cene
DS	DZ *e.g.* su**ds**	Hu**ds**on
PZ	PS *e.g.* sla**ps**	—
TZ	TS *e.g.* cur**tsy**	—
KZ	KS *e.g.* fi**x**	—
NG	NXG *e.g.* si**ng**ing	**ing**rate
NK	NXK *e.g.* ba**nk**	Su**nk**ist